CLAIMS:

1. An apparatus for atomizing a fluid comprising:

a central passageway comprising at least one feed inlet, an outlet and at least one atomization fluid passageway configured to fluidly communicate with the central passageway at an atomization fluid passageway outlet, the apparatus further comprising a heating zone configured to promote heat exchange between the central passageway and the at least one atomization fluid passageway, the central passageway outlet positioned downstream from the position at which the atomization fluid passageway exits into the central passageway.

2. The apparatus according to claim 1 further comprising a first mixing zone comprising a first inlet for a fluid to be atomized.

3. The apparatus according to claim 2 wherein the first mixing zone further comprises a second inlet for an atomization fluid, the second inlet positioned upstream in the central passageway from the atomizing fluid passageway outlet.

4. The apparatus according to claim 3 wherein the second inlet comprises a sparger.

5. The apparatus according to claim 3 further comprising a stream splitter positioned within the central passageway upstream from the atomization fluid passageway outlet.

6. The apparatus according to claim 1 wherein the atomization fluid passageway outlets have a forward acute angle greater than 60°.

7. The apparatus according to claim 1 wherein the central passageway has a circular cross-section and wherein the atomization fluid passageway outlets are positioned concentrically about a perimeter of the central passageway.

8. The apparatus according to claim 1 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

9. The apparatus according to claim 1 wherein the central passageway outlet comprises an atomizing zone downstream from the heating zone.

10. The apparatus according to claim 9 wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough.

11. The apparatus according to claim 10 wherein the spray distributor fluid passageway has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

12. The apparatus according to claim 9 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway, wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough, the spray distributor fluid passageway having a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway, wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are co-planar.

13. The apparatus according to claim 1 wherein the central passageway is configured to promote mixing between the fluid to be atomized and the atomization fluid.

14. The apparatus according to claim 9 wherein the atomization zone has a cross-section comprising two dimensions and wherein at least one of the dimensions converges in a downstream direction along at least a portion of the length of the atomization zone.

15. An apparatus for atomizing a fluid comprising:

(a) a central passageway comprising at least one feed inlet for a fluid to be atomized;

(b) an atomization zone positioned downstream from the at least one feed inlet;

(c) and at least one atomization fluid passageway configured to fluidly communicate with the central passageway via an atomization fluid passageway

outlet, wherein the atomization fluid passageway outlets have a forward acute angle greater than 60° and are positioned concentrically about a perimeter of the central passageway; and,

(d) a heating zone configured to promote heat exchange between the central passageway and the at least one atomization fluid passageway, wherein the heating zone is positioned upstream from the atomization zone.

16. The apparatus according to claim 15 further comprising a second inlet for atomization fluid positioned upstream from the atomization fluid passageway outlet.

17. The apparatus according to claim 16 wherein the second inlet comprises a sparger.

18. The apparatus according to claim 15 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

19. The apparatus according to claim 15 wherein the atomization zone has a cross-section comprising two dimensions and wherein at least one of the dimensions converges in a downstream direction along at least a portion of the length of the atomization zone.

20. An apparatus for atomizing a fluid comprising:

(a) a central passageway comprising at least one inlet for a fluid to be atomized;

(b) an atomization zone positioned downstream from the at least one inlet;

(c) at least one atomization fluid passageway configured to fluidly communicate with the central passageway via an atomization fluid passageway outlet, wherein the atomization fluid passageway outlets have a forward acute angle greater than 60° and are positioned concentrically about a perimeter of the central passageway; and,

(d) a heating zone configured to promote heat exchange between the central passageway and the at least one atomization fluid passageway;

(e) a stream splitter positioned within the central passageway upstream from the atomization fluid passageway outlets,

wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway, wherein the atomization zone has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the atomization zone.

21. The apparatus according to claim 20 further comprising a second inlet for atomization fluid positioned upstream within the central passageway from the atomization fluid passageway outlet.

22. The apparatus according to claim 21 wherein the second inlet comprises a sparger.

23. The apparatus according to claim 21 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

24. The apparatus according to claim 21 wherein the atomizing zone is downstream from the heating zone.

25. The apparatus according to claim 21 wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are co-planar.

26. A fluidized catalytic cracking unit comprising a reactor comprising at least one feed nozzle, wherein at least one of the feed nozzles comprises:

(i) a central passageway comprising at least one FCC feed inlet;

(ii) an outlet comprising an atomization zone in fluid communication with the reactor;

(iii) at least one atomization fluid passageway fluidly communicating with the central passageway via an atomization fluid passageway outlet; and,

(iv) a heating zone configured to promote heat exchange between the FCC feed and the atomization fluid before the FCC feed and atomization fluid mix.

27. The fluidized catalytic cracking unit according to claim 26 wherein the at least one feed nozzle further comprises a first mixing zone comprising a second inlet for an atomization fluid positioned upstream from the atomization fluid passageway outlet.

28. The fluidized catalytic cracking unit according to claim 27 wherein the second inlet comprises a sparger.

29. The fluidized catalytic cracking unit according to claim 26 wherein the central passageway further comprises a stream splitter positioned within the central passageway upstream from the position at which the atomization fluid passageway exits into the central passageway.

30. The fluidized catalytic cracking unit according to claim 26 wherein the atomization fluid passageway outlets have a forward acute angle greater than 60°.

31. The fluidized catalytic cracking unit according to claim 26 wherein the central passageway has a circular cross-section and wherein the atomization fluid passageway outlets are positioned concentrically about the central passageway.

32. The fluidized catalytic cracking unit according to claim 26 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

33. The a fluidized catalytic cracking unit according to claim 26 wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough.

34. The fluidized catalytic cracking unit according to claim 33 wherein the spray distributor fluid passageway has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

35. The fluidized catalytic cracking unit according to claim 32 wherein the atomizing zone further comprises a spray distributor comprising a fluid passageway extending therethrough and wherein the spray distributor fluid passageway has a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

36. The fluidized catalytic cracking unit according to claim 35 wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are co-planar.

37. The fluidized catalytic cracking unit according to claim 25 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

38. The fluidized catalytic cracking unit according to claim 25 comprising a plurality of the feed nozzles.

39. The apparatus according to claim 8 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

40. The apparatus according to claim 15 wherein the central passageway has a cross-section having two-dimensions, wherein both dimensions converge in a downstream direction along at least a portion of the length of the central passageway.

41. A nozzle for atomizing a petroleum product comprising:

(i) a central passageway comprising at least one petroleum feed inlet;

(ii) an outlet comprising an atomization zone and a spray distributor configured to promote a predetermined spray pattern;

(iii) at least one atomization fluid passageway fluidly communicating with the central passageway via an atomization fluid passageway outlet; and,

(iv) a heating zone configured to promote heat exchange between the petroleum feed and the atomization fluid before the petroleum feed and atomization fluid mix.

42. The nozzle according to claim 41 further comprising a second inlet for an atomization fluid positioned upstream from the atomization fluid passageway outlet.

43. The nozzle according to claim 42 wherein the second inlet comprises a sparger.

44. The nozzle according to claim 41 wherein the central passageway further comprises a stream splitter positioned within the central passageway upstream from the position at which the atomization fluid passageway exits into the central passageway.

45. The nozzle according to claim 41 wherein the atomization fluid passageway outlets have a forward acute angle greater than 60°.

46. The nozzle according to claim 41 wherein the central passageway has a circular cross-section and wherein the atomization fluid passageway outlets are positioned concentrically about the central passageway.

47. The nozzle according to claim 41 wherein the central passageway has a cross-section having two-dimensions, wherein at least one of the two dimensions converges in a downstream direction along at least a portion of the length of the central passageway.

48. The nozzle according to claim 41 wherein the spray distributor fluid comprises a passageway having a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

49. The nozzle according to claim 47 wherein the spray distributor fluid comprises a passageway having a cross-section comprising two dimensions and wherein at least one of the dimensions diverges in a downstream direction along at least a portion of the length of the spray distributor fluid passageway.

50. The nozzle according to claim 49 wherein the converging dimension of the central passageway and the diverging dimension of the spray distributor fluid passageway are co-planar.

51. The apparatus according to claim 4 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

52. The apparatus according to claim 17 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

53. The apparatus according to claim 22 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

54. The apparatus according to claim 28 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.

55. The apparatus according to claim 43 wherein said sparger comprises at least one fluid passageway configured to allow fluid passage into said central passageway, wherein said sparger fluid passageways are configured to promote radial flow, axial flow, or combinations thereof, said flow relative to the overall direction of fluid flow in said central passageway.